## SEQUENCE LISTING

| <110> Berry, Alan   |    |
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| Burlingame, Richard P.                                    |    |
| Millis, James R.  |    |
| <120> PROCESS AND MATERIALS FOR PRODUCTION OF GLUCOSAMINE |    |
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| <150> PCT/US98/00800                                      |    |
| <151> 1998-01-14  |    |
| <150> 60/035,494  |    |
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<sup>&</sup>lt;211> 1830

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<sup>&</sup>lt;213> Escherichia coli

<sup>&</sup>lt;220>

<sup>&</sup>lt;221> CDS

<sup>&</sup>lt;222> (1)..(1830)

<sup>&</sup>lt;400> 15

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1 5 10 15

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|   |   |   |     |   |  |     |     |     |  |     | cgt<br>Arg        | 144 |
|   |   |   |     |   |  |     |     |     |  |     | _cct<br>Pro       | 192 |
|   |   |   |     |   |  |     |     |     |  |     | ggt<br>Gly        | 240 |
|   |   |   |     |   |  |     |     |     |  |     | gtg<br>Val<br>95  | 288 |
|   |   |   |     |   |  |     |     |     |  |     | gag<br>Glu        | 336 |
|   |   |   |     |   |  |     |     |     |  |     | gtg<br>Val        | 384 |
|   |   |   |     |   |  |     |     |     |  |     | cgt<br>Arg        | 432 |
|   |   |   |     |   |  |     |     |     |  |     | aca<br>Thr        | 480 |
|   | _ | - |     | _ |  |     |     | Leu |  |     | tct<br>Ser<br>175 | 528 |
| - |   |   |     |   |  |     | Gly |     |  |     | gct<br>Ala        | 576 |
| _ | _ |   | Ala |   |  | Thr |     |     |  | Phe | ctt<br>Leu        | 624 |

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|---|---|---|---|---|-------------------|---|---|---|---|---|---|---|---|---|------|
|   |   |   |   |   | gta<br>Val<br>230 |   |   |   |   |   |   |   |   |   | 720  |
|   | _ |   |   | - | aaa<br>Lys        |   |   |   |   |   |   |   | _ |   | 768  |
|   |   | _ | _ | _ | aac<br>Asn        |   |   |   |   |   |   |   |   |   | 816  |
| _ |   |   | _ | - | gat<br>Asp        |   | _ |   | _ |   |   |   |   |   | 864  |
| _ | - | - | _ | _ | gag<br>Glu        |   |   |   |   |   |   |   |   |   | 912  |
|   |   |   |   | _ | gtt<br>Val<br>310 |   | _ |   |   |   |   |   |   |   | 960  |
|   | - | - | _ | - | gaa<br>Glu        |   | - |   |   |   |   |   |   |   | 1008 |
| - |   | _ | _ |   | agc<br>Ser        | _ | _ |   |   | _ |   |   |   |   | 1056 |
|   |   | - |   | _ | gct<br>Ala        |   |   |   |   |   |   |   |   |   | 1104 |
|   |   |   | _ | - | atc<br>Ile        | - |   | - | _ |   |   | _ |   | _ | 1152 |
| - |   | - | - |   | cta<br>Leu<br>390 | _ |   |   |   |   | _ |   |   |   | 1200 |

| - |   |   |   | - |   |   |   |   |   |   | gtg<br>Val        |   |   |   |   | 1248 |
|---|---|---|---|---|---|---|---|---|---|---|-------------------|---|---|---|---|------|
|   |   | _ | _ |   |   |   |   |   |   |   | gcc<br>Ala        |   |   |   |   | 1296 |
| _ |   |   |   |   | _ | _ |   | _ | _ | _ | cgt<br>Arg        |   |   | _ |   | 1344 |
| _ |   | _ | - |   | • |   | _ |   | - | - | gaa<br>Glu<br>460 | - |   |   | _ | 1392 |
|   |   |   |   | _ |   |   |   |   |   |   | cag<br>Gln        |   |   |   |   | 1440 |
| _ | - |   | - | _ | _ | - |   |   |   |   | tac<br>Tyr        |   |   |   |   | 1488 |
| - |   | - | - |   | - | _ |   |   |   | _ | ctg<br>Leu        |   |   |   | _ | 1536 |
| _ | - | _ | _ | _ |   | - | - |   |   |   | aac<br>Asn        |   |   |   |   | 1584 |
|   |   |   |   |   |   |   |   |   |   |   | cgt<br>Arg<br>540 |   |   |   |   | 1632 |
|   | _ |   | _ | _ | _ | _ |   |   |   | _ | agt<br>Ser        | _ | _ |   | - | 1680 |
|   |   |   |   | _ | _ |   |   | - |   |   | att<br>Ile        | _ | _ |   |   | 1728 |
|   |   | - | _ | _ |   |   |   |   |   |   | gtc<br>Val        |   |   |   |   | 1776 |

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Ser Pro Leu Val Ile Gly Leu Gly Met Gly Glu Asn Phe Ile Ala Ser 180 185 190

- Asp Gln Leu Ala Leu Leu Pro Val Thr Arg Arg Phe Ile Phe Leu Glu 195 200 205
- Glu Gly Asp Ile Ala Glu Ile Thr Arg Arg Ser Val Asn Ile Phe Asp 210 215 220
- Lys Thr Gly Ala Glu Val Lys Arg Gln Asp Ile Glu Ser Asn Leu Gln 225 230 235 240
- Tyr Asp Ala Gly Asp Lys Gly Ile Tyr Arg His Tyr Met Gln Lys Glu 245 250 255
- Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Ile
  260 265 270
- Ser His Gly Gln Val Asp Leu Ser Glu Leu Gly Pro Asn Ala Asp Glu 275 280 285
- Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 290 295 300
- Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly 305 310 315 320
- Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 325 330 335
- Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 340 345 350
- Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr 355 360 365
- Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 370 375 380
- Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 385 390 395 400
- Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 405 410 415
- Val Ala Lys Leu Ser Arg Leu Lys Gly Leu Asp Ala Ser Ile Glu His
  420 425 430

Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met 435 440 445

Leu Ser Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 450 455 460

Lys His His Ala Leu Phe Leu Gly Arg Gly Asp Gln Tyr Pro Ile Ala 465 470 475 480

Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 485 490 495

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp 500 505 510

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu 515 520 525

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gln Leu 530 535 540

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 545 550 555 560

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe 565 570 575

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys 580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val 595 600 605

Glu

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144 ggt ctg gcc gtt gtt gat gca gaa ggt cat atg acc cgc ctg cgc cgc Gly Leu Ala Val Val Asp Ala Glu Gly His Met Thr Arg Leu Arg Arg 40 35

ctc ggt aaa gtc cag atg ctg gca cag gca gcg gaa gaa cat cct ctg 192 Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu 55 60 50

|   |     |   |       |   |   |  |   |     |     |  | ggt<br>Gly        | 240 |
|---|-----|---|-------|---|---|--|---|-----|-----|--|-------------------|-----|
|   |     |   |       |   |   |  |   |     |     |  | gtg<br>Val<br>95  | 288 |
|   |     |   |       |   |   |  |   |     |     |  | gag<br>_Glu       | 336 |
|   |     |   |       |   |   |  |   |     |     |  | gtg<br>Val        | 384 |
|   |     |   |       |   |   |  |   |     |     |  | cgt<br>Arg        | 432 |
|   |     |   |       |   |   |  |   |     |     |  | aca<br>Thr        | 480 |
|   |     |   |       |   |   |  |   |     |     |  | tct<br>Ser<br>175 | 528 |
| _ | _   | _ |       |   |   |  |   |     |     |  | gct<br>Ala        | 576 |
|   | _   | _ | <br>_ | _ | _ |  | _ | _   |     |  | ctt<br>Leu        | 624 |
|   |     | - |       | _ |   |  |   |     |     |  | ttc<br>Phe        | 672 |
|   | Thr |   |       |   |   |  |   |     | Glu |  | ctg<br>Leu        | 720 |
|   | _   |   |       |   |   |  |   | His |     |  | aaa<br>Lys<br>255 | 768 |

|   |   | _ | _ | _ | aac<br>Asn        |  |  |  |  |  | 816  |
|---|---|---|---|---|-------------------|--|--|--|--|--|------|
| - |   |   | - | _ | gat<br>Asp        |  |  |  |  |  | 864  |
| _ | _ | _ | _ | _ | gag<br>Glu        |  |  |  |  |  | 912  |
|   |   |   |   | - | gtt<br>Val<br>310 |  |  |  |  |  | 960  |
|   | _ | - | - | _ | gaa<br>Glu        |  |  |  |  |  | 1008 |
|   |   |   |   |   | agc<br>Ser        |  |  |  |  |  | 1056 |
|   |   |   |   |   | gct<br>Ala        |  |  |  |  |  | 1104 |
|   |   |   |   |   | atc<br>Ile        |  |  |  |  |  | 1152 |
|   |   |   |   |   | cta<br>Leu<br>390 |  |  |  |  |  | 1200 |
| _ |   |   |   | - | ttc<br>Phe        |  |  |  |  |  | 1248 |
|   |   |   |   |   | cgc<br>Arg        |  |  |  |  |  | 1296 |
| - |   |   |   | - | ctg<br>Leu        |  |  |  |  |  | 1344 |

<212> PRT

| -ctg<br>Leu |              | cag<br>Gln        |  |  |     |  |  |     |     |                   | 1392 |
|-------------|--------------|-------------------|--|--|-----|--|--|-----|-----|-------------------|------|
|             |              | cac<br>His        |  |  |     |  |  |     |     |                   | 1440 |
|             |              | ggc<br>Gly        |  |  |     |  |  |     |     |                   | 1488 |
|             |              | gct<br>Ala        |  |  |     |  |  |     |     |                   | 1536 |
|             |              | atg<br>Met<br>515 |  |  |     |  |  |     |     |                   | 1584 |
|             |              | aaa<br>Lys        |  |  |     |  |  |     |     | ttg<br>Leu        | 1632 |
|             |              | ttc<br>Phe        |  |  |     |  |  |     |     | atg<br>Met<br>560 | 1680 |
|             |              |                   |  |  |     |  |  |     |     | ttc<br>Phe        | 1728 |
|             |              |                   |  |  |     |  |  |     | Ile | aaa<br>Lys        | 1776 |
|             |              |                   |  |  | Asn |  |  | Val |     | gtt<br>Val        | 1824 |
| gag<br>Glu  | taa<br>610   |                   |  |  |     |  |  |     |     |                   | 1830 |
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## <213> Escherichia coli

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- Leu Leu Glu Gly Leu Arg Arg Leu Glu Tyr Arg Gly Tyr Asp Ser Ala 20 25 30
- Gly Leu Ala Val Val Asp Ala Glu Gly His Met Thr Arg Leu Arg Arg
  35 40 45
- Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu 50 55 60
- His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu 65 70 75 80
- Pro Ser Glu Val Asn Ala His Pro His Val Ser Glu His Ile Val Val 85 90 95
- Val His Asn Gly Ile Ile Glu Asn His Glu Pro Leu Arg Glu Glu Leu 100 105 110
- Lys Ala Arg Gly Tyr Thr Phe Val Ser Glu Thr Asp Thr Glu Val Ile 115 120 125
- Ala His Leu Val Asn Trp Glu Leu Lys Gln Gly Gly Thr Leu Arg Glu 130 135 140
- Ala Val Leu Arg Ala Ile Pro Gln Leu Arg Gly Ala Tyr Gly Thr Val 145 150 155 160
- Ile Met Asp Ser Arg His Pro Asp Thr Leu Leu Ala Ala Arg Ser Gly
  165 170 175
- Ser Pro Leu Val Ile Gly Leu Gly Met Gly Glu Asn Phe Ile Ala Ser 180 185 190
- Asp Gln Leu Ala Leu Leu Pro Val Thr Arg Arg Phe Ile Phe Leu Glu 195 200 205
- Glu Gly Asp Ile Ala Glu Ile Thr Arg Arg Ser Val Asn Ile Phe Asp 210 215 220
- Lys Thr Gly Ala Glu Val Lys Arg Gln Asp Ile Glu Ser Asn Leu Gln 225 230 235 240

| Tyr | Asp | Ala | Gly | Asp | Lys | Gly | Ile | Tyr | Arg | His | Tyr | Met | Gln | Lys | Glu |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     | 245 |     |     |     |     | 250 |     |     |     |     | 255 |     |

- Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Thr 260 265 270
- Ser His Gly Gln Val Asp Leu Ser Glu Leu Gly Pro Asn Ala Asp Glu 275 280 285
- Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 290 295 300
- Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly 305 310 315 320
- Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 325 330 335
- Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 340 345 350
- Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr
  355 360 365
- Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 370 375 380
- Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 385 390 395 400
- Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 405 410 415
- Val Ala Lys Leu Ser Arg Leu Lys Gly Leu Asp Ala Ser Ile Glu His
  420 425 430
- Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met 435 440 445
- Leu Pro Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 450 455 460
- Lys His His Ala Leu Phe Leu Gly Arg Gly Asp Gln Tyr Pro Ile Ala 465 470 475 480
- Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 485 490 495

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp
500 505 510

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu 515 520 525

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gln Leu 530 535 540

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 545 550 555 560

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe 565 570 575

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys 580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val 595 600 605

Glu

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ggt ctg gcc gtt gtt gat aca gaa ggt cat atg acc cgc ctg cgt cgc 144 Gly Leu Ala Val Val Asp Thr Glu Gly His Met Thr Arg Leu Arg Arg 45 35

ctc ggt aaa gtc cag atg ctg gca cag gca gcg gaa gaa cat cct ctg 192 Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu 55 50

cat ggc ggc act ggt att gct cac act cgc tgg gcg acc cac ggt gaa 240 His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu 70 75 65

cct tca gaa gtg aat gcg cat ccg cat gtt tct gaa cac att gtg gtg Pro Ser Glu Val Asn Ala His Pro His Val Ser Glu His Ile Val Val 90 95 85

gtg cat aac ggc atc atc gaa aac cat gaa ccg ctg cgt gaa gag cta Val His Asn Gly Ile Ile Glu Asn His Glu Pro Leu Arg Glu Glu Leu 100 105

aaa gcg cgt ggc tat acc ttc gtt tct gaa acc gac acc gaa gtg att

|   | Lys | Ala | Arg<br>115 | Gly | Tyr | Thr | Phe | Val<br>120 | Ser | Glu | Thr | Asp | Thr<br>125 | Glu | Val               | Ile        |     |
|---|-----|-----|------------|-----|-----|-----|-----|------------|-----|-----|-----|-----|------------|-----|-------------------|------------|-----|
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | cgt<br>Arg        |            | 432 |
| • |     |     |            |     |     |     |     |            |     |     |     |     |            |     | aca<br>Thr        |            | 480 |
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | tct<br>Ser<br>175 |            | 528 |
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | gct<br>Ala        |            | 576 |
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | ctt<br>Leu        |            | 624 |
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | ttc<br>Phe        |            | 672 |
|   |     |     |            |     | -   |     |     |            |     |     |     | Glu |            |     | ctg<br>Leu        |            | 720 |
|   |     |     |            |     |     |     |     |            |     |     |     |     |            |     | aaa<br>Lys<br>255 | gag<br>Glu | 768 |
|   |     |     |            |     | Pro |     |     |            |     |     |     |     |            |     | cgc<br>Arg        |            | 816 |
|   | _   |     |            | Gln |     |     |     |            | Glu |     |     |     |            |     | gac<br>Asp        |            | 864 |
|   |     |     | Ser        |     |     |     |     | Ile        |     |     |     |     | Cys        |     | act<br>Thr        | tct<br>Ser | 912 |
|   | tat | aac | tcc        | ggt | atg | gtt | tcc | cgc        | tac | tgg | ttt | gaa | tcg        | cta | gca               | ggt        | 960 |

| • | Tyr<br>305 | Asn        | Ser        | Gly        | Met               | Val<br>310 | Ser        | Arg        | Tyr        | Trp               | Phe<br>315 | Glu        | Ser        | Leu        | Ala               | Gly<br>320        |      |
|---|------------|------------|------------|------------|-------------------|------------|------------|------------|------------|-------------------|------------|------------|------------|------------|-------------------|-------------------|------|
|   | att<br>Ile | ccg<br>Pro | tgc<br>Cys | gac<br>Asp | gtc<br>Val<br>325 | gaa<br>Glu | atc<br>Ile | gcc<br>Ala | tcc<br>Ser | gaa<br>Glu<br>330 | ttc<br>Phe | cgc<br>Arg | tat<br>Tyr | cgc<br>Arg | aaa<br>Lys<br>335 | tct<br>Ser        | 1008 |
|   |            |            |            |            | aac<br>Asn        |            |            |            |            |                   |            |            | Gln        |            | Gly               |                   | 1056 |
|   |            |            |            |            | ctg<br>Leu        |            |            |            |            |                   |            |            |            |            |                   |                   | 1104 |
|   |            |            |            |            | gca<br>Ala        |            |            |            |            |                   |            |            |            |            |                   |                   | 1152 |
|   |            |            |            |            | gcg<br>Ala        |            |            |            |            |                   |            |            |            |            |                   |                   | 1200 |
|   |            |            |            |            | gca<br>Ala<br>405 |            |            |            |            |                   |            |            |            |            |                   |                   | 1248 |
|   |            |            |            |            | tct<br>Ser        |            |            |            |            |                   |            |            |            |            | Glu               |                   | 1296 |
|   |            |            |            | His        | ggt<br>Gly        |            |            |            | Leu        |                   |            |            |            | Glu        |                   | atg<br>Met        | 1344 |
|   |            |            | Gln        |            |                   |            |            |            |            |                   |            |            |            |            |                   | gac<br>Asp        | 1392 |
|   |            |            |            |            |                   |            | Leu        |            |            |                   |            | Gln        |            |            |                   | gcg<br>Ala<br>480 | 1440 |
|   |            |            |            |            |                   | Lys        |            |            |            |                   | Ser        |            |            |            |                   | gaa<br>Glu        | 1488 |
|   | gcc        | tac        | gct        | gct        | ggc               | gaa        | ctg        | aaa        | cac        | ggt               | ccg        | ctg        | gcg        | cta        | att               | gat               | 1536 |

| • | Āla   | Tyr   | Ala      | Ala<br>500 | Gly        | Glu   | Leu   | Lys  | His<br>505  | Gly   | Pro | Leu   | Ala | Leu<br>510 | Ile         | Asp   |      |
|---|-------|-------|----------|------------|------------|-------|-------|------|-------------|-------|-----|-------|-----|------------|-------------|-------|------|
|   |       |       |          |            | ~++        | a++   | ~++   | at t | gca         | cca   | aac | aac   | αаа | tta        | cta         | gaa   | 1584 |
|   | gcc   | gat   | atg      | ccg        | gul<br>Wal | Tla   | Val   | Val  | Ala         | Pro   | Asn | Asn   | Glu | Leu        | Leu         | Glu   |      |
|   | ALA   | Asp   |          | PIO        | val        | 116   | Vai   | 520  | <i>n</i> _u |       |     |       | 525 |            |             |       |      |
|   |       |       | 515      |            |            |       |       | 320  |             |       |     |       |     |            |             |       |      |
|   |       |       |          | taa        | 220        | a++   | ma a  | maa  | gtt         | cac   | aca | cat   | aac | aat        | caq         | ttq   | 1632 |
|   | aaa   | Tou   | 7        | 202        | nac<br>nen | Tla   | Glu   | Glu  | Val         | Ara   | Ala | Arg   | Glv | Glv        | Gln         | Leu   |      |
|   | гÀг   | 530   | гЛя      | Ser        | ASII       | 116   | 535   | Giu  | Vul         | 711.9 |     | 540   | 3   | 2          |             |       |      |
|   |       | 530   |          |            |            |       | 333   |      |             |       |     |       |     | •          | -           |       |      |
|   | +=+   | ata   | ttc      | acc        | gat        | cad   | gat   | aca  | aat         | ttt   | gta | agt   | agc | gat        | aac         | atg   | 1680 |
|   | Tur   | Val   | Dhe      | Δla        | Asn        | Gln   | Asp   | Ala  | Gly         | Phe   | Val | Ser   | Ser | Asp        | Asn         | Met   |      |
|   | 545   | Val   | FIIC     | AL u       | , wp       | 550   |       |      | 2           |       | 555 |       |     | -          |             | 560   |      |
|   | 343   |       |          |            |            | 500   |       |      |             |       |     |       |     |            |             |       |      |
|   | cac   | atc   | atc      | gag        | ato        | cca   | cat   | ata  | gaa         | gag   | qtq | att   | gca | ccg        | atc         | ttc   | 1728 |
|   | His   | Tle   | Tle      | Glu        | Met        | Pro   | His   | Val  | Glu         | Glu   | Val | Ile   | Ala | Pro        | Ile         | Phe   |      |
|   | ****  |       |          |            | 565        |       |       |      |             | 570   |     |       |     |            | 575         |       |      |
|   |       |       |          |            | 000        |       |       |      |             |       |     |       |     |            |             |       |      |
|   | tac   | acc   | att      | cca        | cta        | caq   | cta   | ctq  | qct         | tac   | cat | gtc   | gcg | ctg        | atc         | aaa   | 1776 |
|   | Tur   | Thr   | Val      | Pro        | Leu        | Gln   | Leu   | Leu  | Āla         | Tyr   | His | Val   | Ala | Leu        | Ile         | Lys   |      |
|   | - 1 - |       |          | 580        |            |       |       |      | 585         | •     |     |       |     | 590        |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | aac   | acc   | gac      | gtt        | gac        | cag   | ccg   | cgt  | aac         | ctg   | gca | aaa   | tcg | gtt        | acg         | gtt   | 1824 |
|   | Glv   | Thr   | Asp      | Val        | Asp        | Gln   | Pro   | Arg  | Asn         | Leu   | Ala | Lys   | Ser | Val        | Thr         | Val   |      |
|   | •     |       | 595      |            |            |       |       | 600  |             |       |     |       | 605 |            |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | gag   | taa   | L        |            |            |       |       |      |             |       |     |       |     |            |             |       | 1830 |
|   | Glu   |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   |       | 610   | <b>)</b> |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | <21   | .0> 2 | 2        |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | <21   | .1> 6 | 09       |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | <21   | .2> E | PRT      |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   | <21   | .3> E | sche     | rich       | ia c       | oli   |       |      |             |       |     |       |     |            |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |
|   |       | 0> 2  |          |            |            |       |       | _    |             |       |     | _     |     |            | <b>~</b> 3. | 1 -   |      |
|   | Met   | : Cys | Gly      | , Ile      | val        | . Gly | 7 Ala | Ile  | : Ala       |       |     | Asp   | va⊥ | . Ala      |             | ı Ile |      |
|   | 1     |       |          |            | 5          | •     |       |      |             | 10    | ı   |       |     |            | 15          |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       | _   | _          | _           |       |      |
|   | Lev   | ı Leı | ı Glı    | ı Gly      | , Leu      | Arg   | Arg   | Let  |             |       | Arg | , Gl  | туг |            |             | Ala   |      |
|   |       |       |          | 20         | )          |       |       |      | 25          | •     |     |       |     | 30         | 1           |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       | _   | _          | _           |       |      |
|   | Gly   | , Le  | ı Ala    | a Val      | l Val      | Asp   | Thr   |      |             | His   | Met | : Thr |     |            | Arg         | g Arg |      |
|   |       |       | 35       | 5          |            |       |       | 40   | )           |       |     |       | 45  | )          |             |       |      |
|   |       |       |          |            |            |       |       |      |             |       |     |       |     |            |             |       |      |

Leu Gly Lys Val Gln Met Leu Ala Gln Ala Glu Glu His Pro Leu

- His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu 65 70 75 80
- Pro Ser Glu Val Asn Ala His Pro His Val Ser Glu His Ile Val Val 85 90 95
- Val His Asn Gly Ile Ile Glu Asn His Glu Pro Leu Arg Glu Glu Leu 100 105 110
- Lys Ala Arg Gly Tyr Thr Phe Val Ser Glu Thr Asp Thr Glu Val Ile 115 120 125
- Ala His Leu Val Asn Trp Glu Leu Lys Gln Gly Gly Thr Leu Arg Glu 130 135 140
- Ala Val Leu Arg Ala Ile Pro Gln Leu Arg Gly Ala Tyr Gly Thr Val 145 150 155 160
- Ile Met Asp Ser Arg His Pro Asp Thr Leu Leu Ala Ala Arg Ser Gly
  165 170 175
- Ser Pro Leu Val Ile Gly Leu Gly Met Gly Glu Asn Phe Ile Ala Ser 180 185 190
- Asp Gln Leu Ala Leu Leu Pro Val Thr Arg Arg Phe Ile Phe Leu Glu 195 200 205
- Glu Gly Asp Ile Ala Glu Ile Thr Arg Arg Ser Val Asn Ile Phe Asp 210 215 220
- Lys Thr Gly Ala Glu Val Lys Arg Gln Asp Ile Glu Ser Asn Leu Gln 225 230 235 240
- Tyr Asp Ala Gly Asp Lys Gly Ile Tyr Cys His Tyr Met Gln Lys Glu 245 250 255
- Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Ile 260 265 270
- Ser His Gly Gln Val Asp Leu Ser Glu Leu Gly Pro Asn Ala Asp Glu 275 280 285
- Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 290 295 300
- Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly

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Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 

Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 

Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr 

Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 

Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 

Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 

Val Ala Lys Leu Ser Arg Leu Lys Gly Leu Asp Ala Ser Ile Glu His 

Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met 

Leu Ser Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 

Lys His His Ala Leu Phe Leu Ser Arg Gly Asp Gln Tyr Pro Ile Ala 

Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp 

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu 

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gly Gln Leu 

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys
580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val 595 600 605

Glu

<210> 23

<211> 2184

<212> DNA

<213> Escherichia coli

<400> 23 ccgctctaga actagtggat ctcgatcccg cgaaattaat acgactcact ataggggaat 60 tgtgagcgga taacaattcc cctctagaaa taattttgtt taactttaag aaggagatat 120 accatgtgtg gaattgttgg cgcgatcgcg caacgtgatg tagcagaaat ccttcttgaa 180 ggtttacgtc gtctggaata ccgcggatat gactctgccg gtctggccgt tgttgatgca 240 gaaggtcata tgacccgcct gcgtcgcctc ggtaaagtcc agatgctggc acaggcagcg 300 gaagaacatc ctctgcatgg cggcactggt attgctcaca ctcgctgggc gacccacggt 360 gaaccttcag aagtgaatgc gcatccgcat gtttccgaac acattgtggt ggtgcataac 420 ggcatcatcg aaaaccatga accgctgcgt gaagagctaa aagcgcgtgg ctataccttc 480 gtttctgaaa ccgacaccga agtgattgcc catctggtga actgggagct gaaacaaggc 540 gggactctgc gtgaggccgt tctgcgtgct atcccgcagc tgcgtggtgc gtacggtaca 600 gtgatcatgg actcccgtca cccggatacc ctgctggcgg cacgttctgg tagtccgctg 660 gtgattggcc tggggatggg cgaaaacttt atcgcttctg accagctggc gctgttgccg 720 gtgacccgtc gctttatctt ccttgaagag ggcgatattg cggaaatcac tcgccgttcg 780 gtaaacatct tcgataaaac tggcgcggaa gtaaaacgtc aggatatcga atccaatctg 840 caatatgacg cgggcgataa aggcatttac cgtcactaca tgcagaaaga gatctacgaa 900 cagecgaacg egateaaaaa caeeettaee ggaegeatea geeaeggtea ggttgattta 960 agcgagctgg gaccgaacgc cgacgaactg ctgtcgaagg ttgagcatat tcagatcctc 1020 gcctgtggta cttcttataa ctccggtatg gtttcccgct actggtttga atcgctagca 1080 ggtattccgt gcgacgtcga aatcgcctct gaattccgct atcgcaaatc tgccgtgcgt 1140 cgtaacagcc tgatgatcac cttgtcacag tctggcgaaa ccgcggatac cctggctggc 1200 ctgcgtctgt cgaaagagct gggttacctt ggttcactgg caatctgtaa cgttccgggt 1260 tettetetgg tgegegaate egatetggeg etaatgacea aegegggtae agaaategge 1320 gtggcatcca ctaaagcatt caccactcag ttaactgtgc tgttgatgct ggtggcgaag 1380 ctgtctcgcc tgaaaggtct ggatgcctcc attgaacatg acatcgtgca tggtctgcag 1440 gcgctgccga gccgtattga gcagatgctg tctcaggaca aacgcattga agcgctggca 1500 gaagatttct ctgacaaaca tcacgcgccg ttcctgggcc gtggcgatca gtacccaatc 1560 gcgctggaag gcgcattgaa gttgaaagag atctcttaca ttcacgctga agcctacgct 1620 gctggcgaac tgaaacacgg tccgctggcg ctaattgatg ccgatatgcc ggttattgtt 1680 gttgcaccga acaacgaatt gctggaaaaa ctgaaatcca acattgaaga agttcgcgcg 1740 cgtggcggtc agttgtatgt cttcgccgat caggatgcgg gttttgtaag tagcgataac 1800 atgcacatca tegagatgee geatgtggaa gaggtgattg cacegatett etacacegtt 1860 ccgctgcagc tgctggctta ccatgtcgcg ctgatcaaag gcaccgacgt tgaccagccg 1920 cgtaacctgg caaaatcggt tacggttgag taataaatgg atgccctgcg taagcggggc 1980 atttttcttc ctgttatgtt tttaatcaaa catcctgcca actccatgtg acaaaccgtc 2040 atcttcggct actttttctc tgtcacagaa tgaaaatttt tctgtcatct cttcgttatt 2100 aatgtttgta attgactgaa tatcaacgct ctagaggggc tagagcggcc accaccgcgg 2160 2184 tggagctccg tcgacaagct tatc

<sup>&</sup>lt;210> 24

<sup>&</sup>lt;211> 1830

<sup>&</sup>lt;212> DNA

<sup>&</sup>lt;213> Escherichia coli

| <220> <221> CDS <222> (1)(1830) |                     |                  |            |                  |            |                  |                  |            |                  |            |                  |                  |            |                  |            |     |
|---------------------------------|---------------------|------------------|------------|------------------|------------|------------------|------------------|------------|------------------|------------|------------------|------------------|------------|------------------|------------|-----|
| atg                             | 0> 24<br>tgt<br>Cys | gga              | att<br>Ile | gtt<br>Val<br>5  | ggc<br>Gly | gcg<br>Ala       | atc<br>Ile       | gcg<br>Ala | caa<br>Gln<br>10 | cgt<br>Arg | gat<br>Asp       | gta<br>Val       | gca<br>Ala | gaa<br>Glu<br>15 | atc<br>Ile | 48  |
|                                 | ctt<br>Leu          |                  |            |                  |            |                  |                  |            |                  |            |                  |                  |            |                  |            | 96  |
| ggt<br>Gly                      | ctg<br>Leu          | gcc<br>Ala<br>35 | gtt<br>Val | gtt<br>Val       | gat<br>Asp | gca<br>Ala       | gaa<br>Glu<br>40 | ggt<br>Gly | cat<br>His       | atg<br>Met | acc<br>Thr       | cgc<br>Arg<br>45 | ctg<br>Leu | cgt<br>Arg       | cgc<br>Arg | 144 |
| ctc<br>Leu                      | ggt<br>Gly<br>50    | aaa<br>Lys       | gtc<br>Val | cag<br>Gln       | atg<br>Met | ctg<br>Leu<br>55 | gca<br>Ala       | cag<br>Gln | gca<br>Ala       | gcg<br>Ala | gaa<br>Glu<br>60 | gaa<br>Glu       | cat<br>His | cct<br>Pro       | ctg<br>Leu | 192 |
|                                 | ggc                 |                  |            |                  |            |                  |                  |            |                  |            |                  |                  |            |                  |            | 240 |
| cct                             | tca<br>Ser          | gaa<br>Glu       | gtg<br>Val | aat<br>Asn<br>85 | gcg<br>Ala | cat<br>His       | ccg<br>Pro       | cat<br>His | gtt<br>Val<br>90 | tcc<br>Ser | gaa<br>Glu       | cac<br>His       | att<br>Ile | gtg<br>Val<br>95 | gtg<br>Val | 288 |
|                                 | cat<br>His          |                  |            | Ile              |            |                  |                  |            |                  |            |                  |                  |            | Glu              |            | 336 |
|                                 | gcg<br>Ala          |                  |            |                  |            |                  |                  |            |                  |            |                  |                  |            |                  |            | 384 |
|                                 | c cat<br>His<br>130 | Leu              |            |                  |            |                  |                  |            |                  |            |                  | Thr              |            |                  |            | 432 |
|                                 | c gtt<br>a Val      |                  |            |                  |            | Pro              |                  |            |                  |            | Ala              |                  |            |                  |            | 480 |
|                                 | c atg               |                  |            |                  |            |                  |                  |            |                  |            |                  |                  |            |                  |            | 528 |

165 170 175

| - | -   | _   |   |   |   | _   |     | _ |   | - |     |     |   | gct<br>Ala        |   | 576  |
|---|-----|-----|---|---|---|-----|-----|---|---|---|-----|-----|---|-------------------|---|------|
| - | _   | -   |   | _ | _ | _   |     |   | - |   |     |     |   | ctt<br>Leu        |   | 624  |
|   |     | gat |   |   | - |     | act | - | - | _ | -   | aac |   | ttc<br>Phe        | - | 672  |
|   | act |     |   | - | _ | aaa | -   | - | - |   | gaa |     |   | ctg<br>Leu        |   | 720  |
|   | -   |     |   | • |   |     |     |   | _ |   |     | -   | - | aaa<br>Lys<br>255 |   | 768  |
|   |     | -   | _ | _ |   |     |     |   |   |   |     |     |   | cgc<br>Arg        |   | 816  |
| _ |     |     | _ | _ | _ |     | -   | - |   |   | _   |     | - | gac<br>Asp        | _ | 864  |
| _ | _   | _   | _ | - |   |     |     | - |   |   | -   | _   |   | act<br>Thr        |   | 912  |
|   |     |     |   |   |   |     |     |   |   |   |     |     |   | gca<br>Ala        |   | 960  |
|   |     |     |   |   |   |     |     |   | - |   | _   |     | - | aaa<br>Lys<br>335 |   | 1008 |
| - |     | -   | - |   | - | -   | -   |   |   | - |     | -   |   | ggc<br>ggc        | - | 1056 |
|   |     | -   |   | _ | - |     | _   | _ | _ | _ |     |     | _ | ggt<br>Gly        |   | 1104 |

355 360 365

| ctt   | ggt   | tca       | ctg   | gca   | atc | tgt   | aac  | gtt   | ccg  | ggt   | tct   | tct   | ctg  | gtg      | cgc | 1152  |
|-------|-------|-----------|-------|-------|-----|-------|------|-------|------|-------|-------|-------|------|----------|-----|-------|
|       |       |           |       |       |     |       |      | Val   |      |       |       |       |      |          |     |       |
|       | 370   |           |       |       |     | 375   |      |       |      |       | 380   |       |      |          |     |       |
|       | • • • |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| ~~~   | +~~   | ast       | cta   | aca   | cta | ato   | acc  | aac   | aca  | aat   | aca   | gaa   | atc  | ggc      | gtg | 1200  |
|       |       |           |       |       |     |       |      | Asn   |      |       |       |       |      |          |     |       |
|       | Ser   | Asp       | neu   | Ala   | 390 | 1100  | **** |       |      | 395   |       |       |      |          | 400 |       |
| 385   |       |           | ٠.    |       | 390 |       |      |       |      | 393   |       |       |      |          |     |       |
|       |       |           |       |       |     |       |      |       |      | +     | ~+~   | ata   | ++~  | -<br>>+a | cta | 1248  |
| gca   | tcc   | act       | aaa   | gca   | ttc | acc   | act  | cag   | tta  | act   | gug   | Tan   | Tan  | Wat      | Tou | 12.40 |
| Ala   | Ser   | Thr       | Lys   |       | Phe | Thr   | Tnr  | Gln   |      | Thr   | vai   | ьeu   | ьец  |          | Dea |       |
|       |       |           |       | 405   |     |       |      |       | 410  |       |       |       |      | 415      |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     | 1006  |
|       |       |           |       |       |     |       |      | ggt   |      |       |       |       |      |          |     | 1296  |
| Val   | Ala   | Lys       | Leu   | Ser   | Arg | Leu   | Lys  | Gly   | Leu  | Asp   | Ala   | Ser   | Ile  | Glu      | His |       |
|       |       |           | 420   |       |     |       |      | 425   |      |       |       |       | 430  |          |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| gac   | atc   | gtg       | cat   | ggt   | ctg | cag   | gcg  | ctg   | ccg  | agc   | cgt   | att   | gag  | cag      | atg | 1344  |
|       |       |           |       |       |     |       |      | Leu   |      |       |       |       |      |          |     |       |
| •     |       | 435       |       | _     |     |       | 440  |       |      |       |       | 445   |      |          |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| cta   | tet   | cad       | gac   | aaa   | cac | att   | σaa  | gcg   | ctq  | qca   | gaa   | gat   | ttc  | tct      | gac | 1392  |
|       |       |           |       |       |     |       |      | Ālā   |      |       |       |       |      |          |     |       |
| пец   | 450   |           | AUP   | 2,0   | 9   | 455   | -    |       |      |       | 460   | •     |      |          | •   |       |
|       | 420   |           |       |       |     | 100   |      |       |      |       |       |       |      |          |     |       |
|       |       | <b>~~</b> | ~~~   | 224   | ++c | cta   | aac  | cgt   | aac  | gat   | cad   | tac   | сса  | atc      | aca | 1440  |
|       |       |           |       |       |     |       |      | Arg   |      |       |       |       |      |          |     |       |
| -     |       | HIS       | Ата   | PIO   |     | ьeu   | GIY  | Arg   | GIY  | 475   | GIII  | 171   | 110  | 110      | 480 |       |
| 465   |       |           |       |       | 470 |       |      |       |      | 4/5   |       |       |      |          | 400 |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      | ~~+      | ~~~ | 1488  |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          | gaa | 1400  |
| Leu   | Glu   | Gly       | Ala   |       |     | Leu   | Lys  | Glu   |      |       | Tyr   | тте   | HIS  |          | GIU |       |
|       |       |           |       | 485   |     |       |      |       | 490  |       |       |       |      | 495      |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
|       |       |           |       |       |     |       |      | cac   |      |       |       |       |      |          |     | 1536  |
| Ala   | Tyr   | Ala       | Ala   | Gly   | Glu | Leu   | Lys  | His   | Gly  | Pro   | Leu   | Ala   | Leu  | Ile      | Asp |       |
|       |       |           | 500   |       |     |       |      | 505   |      |       |       |       | 510  |          |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| qcc   | gat   | atg       | ccg   | gtt   | att | gtt   | gtt  | gca   | ccg  | aac   | aac   | gaa   | ttg  | ctg      | gaa | 1584  |
| Ala   | Asp   | Met       | Pro   | Val   | Ile | Val   | Val  | Ala   | Pro  | Asn   | Asn   | Glu   | Leu  | Leu      | Glu |       |
|       | _     | 515       | )     |       |     |       | 520  | )     |      |       |       | 525   |      |          |     |       |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| aaa   | cto   | aaa       | tcc   | aac   | att | gaa   | gaa  | gtt   | cgc  | gcq   | cgt   | ggc   | ggt  | cag      | ttg | 1632  |
|       | _     |           |       |       |     |       |      |       |      |       |       |       |      |          | Leu |       |
| 2,5   | 530   | _         |       | ••    |     | 535   |      |       | ,    |       | 540   |       | -    |          |     |       |
|       | 550   | •         |       |       |     |       |      |       |      |       |       |       |      |          |     |       |
| + - + | +.    | . ++-     | . ~~~ | · ~=+ |     | r mat | acc  | r aat | +++  | . σta | ant   | age   | gat  | aac      | atg | 1680  |
|       |       |           |       |       |     |       |      |       |      |       |       |       |      |          | Met |       |
| туг   | val   | . rue     | : ATa | MSP   | GII | . Asp | , MT | . Gry | 5116 | . val | . Jei | . JEL | بإصح |          |     |       |

550

cac atc atc gag atg ccg cat gtg gaa gag gtg att gca ccg atc ttc 1728

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe

565 570 575

tac acc gtt ccg ctg cag ctg ctg gct tac cat gtc gcg ctg atc aaa 1776

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys

580 585 590

ggc acc gac gtt gac cag ccg cgt aac ctg gca aaa tcg gtt acg gtt 1824
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gag taa 1830

Glu

545

610

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<213> Escherichia coli

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Gly Leu Ala Val Val Asp Ala Glu Gly His Met Thr Arg Leu Arg Arg 35 40 45

Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu 50 55 60

His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu 65 70 75 80

Pro Ser Glu Val Asn Ala His Pro His Val Ser Glu His Ile Val Val 85 90 95

Val His Asn Gly Ile Ile Glu Asn His Glu Pro Leu Arg Glu Glu Leu 100 105 110

Lys Ala Arg Gly Tyr Thr Phe Val Ser Glu Thr Asp Thr Glu Val Ile 115 120 125 Ala His Leu Val Asn Trp Glu Leu Lys Gln Gly Gly Thr Leu Arg Glu Ala Val Leu Arg Ala Ile Pro Gln Leu Arg Gly Ala Tyr Gly Thr Val Ile Met Asp Ser Arg His Pro Asp Thr Leu Leu Ala Ala Arg Ser Gly Ser Pro Leu Val Ile Gly Leu Gly Met Gly Glu Asn Phe Ile Ala Ser Asp Gln Leu Ala Leu Leu Pro Val Thr Arg Arg Phe Ile Phe Leu Glu Glu Gly Asp Ile Ala Glu Ile Thr Arg Arg Ser Val Asn Ile Phe Asp Lys Thr Gly Ala Glu Val Lys Arg Gln Asp Ile Glu Ser Asn Leu Gln Tyr Asp Ala Gly Asp Lys Gly Ile Tyr Arg His Tyr Met Gln Lys Glu Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Ile Ser His Gly Gln Val Asp Leu Ser Glu Leu Gly Pro Asn Ala Asp Glu Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 

Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly 

Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 

Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 

Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr 

Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 

Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 385 390 395 400

Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 405 410 415

Val Ala Lys Leu Ser Arg Leu Lys Gly Leu Asp Ala Ser Ile Glu His
420 425 430

Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met 435 440 445

Leu Ser Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 450 455 460

Lys His His Ala Pro Phe Leu Gly Arg Gly Asp Gln Tyr Pro Ile Ala 465 470 475 480

Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 485 490 495

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp 500 505 510

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu 515 520 525

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gln Leu 530 535 540

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 545 550 555 560

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe 565 570 575

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys 580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val
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<213> Escherichia coli

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1 5 10 15

ctt ctt gaa ggt tta cgt cgt ctg gaa tac cgc gga tat gac tct gcc 96 Leu Leu Glu Gly Leu Arg Arg Leu Glu Tyr Arg Gly Tyr Asp Ser Ala 20 25 30

| ggt<br>Gly | ctg<br>Leu | gcc<br>Ala<br>35 | gtt<br>Val | gtt<br>Val | gat<br>Asp | gca<br>Ala | gaa<br>Glu<br>40 | ggt<br>Gly | cat<br>His | atg<br>Met | acc<br>Thr | cgc<br>Arg<br>45 | ctg<br>Leu | cgt<br>Arg        | cgc<br>Arg | 144 |
|------------|------------|------------------|------------|------------|------------|------------|------------------|------------|------------|------------|------------|------------------|------------|-------------------|------------|-----|
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | cct<br>Pro        |            | 192 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | _ggt<br>Gly       |            | 240 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | gtg<br>Val<br>95  |            | 288 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | gag<br>Glu        |            | 336 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | gtg<br>Val        |            | 384 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | cgt<br>Arg        |            | 432 |
|            |            |                  |            |            |            |            |                  |            |            |            |            |                  |            | aca<br>Thr        |            | 480 |
|            |            |                  |            |            |            |            |                  |            |            | Leu        |            |                  |            | tct<br>Ser<br>175 | Gly        | 528 |
|            |            |                  |            | Ile        |            |            |                  |            | Gly        |            |            |                  |            | gct<br>Ala        |            | 576 |
|            |            |                  | Ala        |            |            |            |                  | Thr        |            |            |            |                  | Phe        |                   | gaa<br>Glu | 624 |
|            |            | Asp              |            |            |            |            | Thr              |            |            |            |            | Asn              |            |                   | gat<br>Asp | 672 |

|   |     |     |   |   | gta<br>Val<br>230 |     |  |     |  |  |            | 720  |
|---|-----|-----|---|---|-------------------|-----|--|-----|--|--|------------|------|
|   |     |     |   |   | aaa<br>Lys        |     |  |     |  |  |            | 768  |
|   |     | -   |   |   | aac<br>Asn        |     |  |     |  |  |            | 816  |
|   |     |     |   |   | gat<br>Asp        |     |  |     |  |  |            | 864  |
|   |     |     |   |   | gag<br>Glu        |     |  |     |  |  |            | 912  |
|   |     |     |   |   | gtt<br>Val<br>310 |     |  |     |  |  |            | 960  |
|   |     |     |   |   | gaa<br>Glu        |     |  |     |  |  |            | 1008 |
|   |     |     |   |   | agc<br>Ser        |     |  |     |  |  |            | 1056 |
|   |     |     |   |   | gct<br>Ala        |     |  |     |  |  |            | 1104 |
|   |     | Ser | - |   | atc<br>Ile        | Asn |  |     |  |  |            | 1152 |
| - | Ser | -   | _ |   | cta<br>Leu<br>390 |     |  |     |  |  |            | 1200 |
| _ |     |     |   | - | Phe               |     |  | Thr |  |  | ctg<br>Leu | 1248 |

|   |   | aag<br>Lys        | - |   | _ |   |   |   |   |   |   |   |   |   |   | 1296 |
|---|---|-------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|------|
| _ |   | gtg<br>Val<br>435 |   |   | _ | _ |   |   |   |   |   |   |   |   |   | 1344 |
| _ |   | cag<br>Gln        | - |   | - |   |   |   |   |   |   |   |   |   |   | 1392 |
|   |   | cac<br>His        |   | _ |   |   |   |   |   |   |   |   |   |   |   | 1440 |
| - | - | ggc<br>Gly        | - | _ | _ | _ |   |   |   |   |   |   |   |   |   | 1488 |
| - |   | gct<br>Ala        | _ |   | - | _ |   |   |   | _ | _ | - |   |   |   | 1536 |
| - | _ | atg<br>Met<br>515 | - | - |   | - | _ | - | _ |   |   | - |   |   |   | 1584 |
|   | _ | aaa<br>Lys        |   |   |   | - | - | - | _ |   | _ |   |   | _ | - | 1632 |
|   | - | ttc<br>Phe        | _ |   |   |   |   |   |   |   |   |   |   |   |   | 1680 |
|   |   | atc<br>Ile        |   | _ | _ |   |   | - |   |   |   | - | - |   |   | 1728 |
|   |   | gtt<br>Val        | _ | _ | - | _ | _ | _ |   |   | _ | - | _ |   |   | 1776 |
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gag taa Glu

610

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<211> 609

<212> PRT

<213> Escherichia coli

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Gly Leu Ala Val Val Asp Ala Glu Gly His Met Thr Arg Leu Arg Arg
35 40 45

Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu 50 55 60

His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu 65 70 75 80

Pro Ser Glu Val Asn Ala His Pro His Val Ser Glu His Ile Val Val 85 90 95

Val His Asn Gly Ile Ile Glu Asn His Glu Pro Leu Arg Glu Glu Leu 100 105 110

Lys Ala Arg Gly Tyr Thr Phe Val Ser Glu Thr Asp Thr Glu Val Ile 115 120 125

Ala His Leu Val Asn Trp Glu Leu Lys Gln Gly Gly Thr Leu Arg Glu 130 135 140

Ala Val Leu Arg Ala Ile Pro Gln Leu Arg Gly Ala Tyr Gly Thr Val 145 150 155 160

Ile Met Asp Ser Arg His Pro Asp Thr Leu Leu Ala Ala Arg Ser Gly
165 170 175

Ser Pro Leu Val Ile Gly Leu Gly Met Gly Glu Asn Phe Ile Ala Ser 180 185 190 Asp Gln Leu Ala Leu Leu Pro Val Thr Arg Arg Phe Ile Phe Leu Glu 195 200 205

Glu Gly Asp Ile Ala Glu Ile Thr Arg Arg Ser Val Asn Ile Phe Asp 210 215 220

Lys Thr Gly Ala Glu Val Lys Arg Gln Asp Ile Glu Ser Asn Leu Gln 225 230 235 240

Tyr Asp Ala Gly Asp Lys Gly Ile Tyr Arg His Tyr Met Gln Lys Glu 245 250 255

Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Ile
260 265 270

Ser His Gly Gln Val Asp Leu Ser Glu Leu Gly Pro Asn Ala Asp Glu 275 280 285

Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 290 295 300

Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly 305 310 315 320

Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 325 330 335

Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 340 345 350

Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr 355 360 365

Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 370 375 380

Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 385 390 395 400

Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 405 410 415

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420 425 430

Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met 435 440 445

Leu Ser Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 450 455 460

Lys His His Ala Leu Phe Leu Ser Arg Gly Asp Gln Tyr Pro Ile Ala 465 470 475 480

Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 485 490 495

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp 500 505 510

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu 515 520 525

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gln Leu 530 535 540

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 545 550 555 560

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe
565 570 575

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys 580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val 595 600 605

Glu

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atgcacatca tcgagatgcc gcatgtggaa gaggtgattg caccgatctt ctacaccgtt 1860
ccgctgcagc tgctggctta ccatgtcgcg ctgatcaaag gcaccgacgt tgaccagccg 1920
cgtaacctgg caaaatcggt tacggttgag taataaatgg atgccctgcg taagcggggc 1980
attttcttc ctgttatgtt tttaatcaaa catcctgcca actccatgtg acaaaccgtc 2040
atcttcggct acttttctc tgtcacagaa tgaaaattt tctgtcatct cttcgttatt 2100
aatgtttgta attgactgaa tatcaacgct ctagggggc tagagcggcc gccaccgcgg 2160
tggagctccg tcgacaagct tatc 2184

<210> 30 <211> 1830 <212> DNA <213> Escherichia coli

<221> CDS <222> (1)..(1830)

ctt ctt gaa ggt tta cgt cgt ctg gaa tac cgc gga tat gac tct gcc 96 Leu Leu Glu Gly Leu Arg Arg Leu Glu Tyr Arg Gly Tyr Asp Ser Ala 20 25 30

ggt ctg gcc gtt gtt gat gca gaa ggt cat atg acc cgc ctg cgt cgc 144
Gly Leu Ala Val Val Asp Ala Glu Gly His Met Thr Arg Leu Arg Arg
35 40 45

ctc ggt aaa gtc cag atg ctg gca cag gca gcg gaa gaa cat cct ctg 192
Leu Gly Lys Val Gln Met Leu Ala Gln Ala Ala Glu Glu His Pro Leu
50 55 60

cat ggc ggc act ggt att gct cac act cgc tgg gcg acc cac ggt gaa 240
His Gly Gly Thr Gly Ile Ala His Thr Arg Trp Ala Thr His Gly Glu
65 70 75 80

|   |   |   |   | gcg<br>Ala        |  |  |  |  |     | 288 |
|---|---|---|---|-------------------|--|--|--|--|-----|-----|
|   |   |   |   | atc<br>Ile        |  |  |  |  |     | 336 |
|   |   |   |   | acc<br>Thr        |  |  |  |  |     | 384 |
| _ |   | _ |   | tgg<br>Trp        |  |  |  |  |     | 432 |
| - | _ | - | _ | atc<br>Ile<br>150 |  |  |  |  |     | 480 |
|   |   |   |   | cac<br>His        |  |  |  |  |     | 528 |
| _ | _ |   |   | ggc               |  |  |  |  |     | 576 |
|   |   |   |   | ttg<br>Leu        |  |  |  |  |     | 624 |
|   |   |   |   | gaa<br>Glu        |  |  |  |  |     | 672 |
|   |   |   |   | gta<br>Val<br>230 |  |  |  |  |     | 720 |
|   | _ |   |   | aaa<br>Lys        |  |  |  |  |     | 768 |
|   |   | _ |   | aac<br>Asn        |  |  |  |  | Arg | 816 |

|      |     |           |             |      | gat |              |             |     |     |         |      |       |      |        |             | 864  |
|------|-----|-----------|-------------|------|-----|--------------|-------------|-----|-----|---------|------|-------|------|--------|-------------|------|
| Ser  | His | Gly       | Gln         | Val  | Asp | Leu          | Ser         | Glu | Leu | Gly     | Pro  | Asn   | Ala  | Asp    | Glu         |      |
|      |     | 275       |             |      |     |              | 280         |     |     |         |      | 285   |      |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
| ctg  | ctg | tcg       | aag         | gtt  | gag | cat          | att         | cag | atc | ctc     | gcc  | tgt   | ggt  | act    | tct         | 912  |
| Leu  | Leu | Ser       | Lys         | Val  | Glu | His          | Ile         | Gln | Ile | Leu     | Ala  | Cys   | Gly  | Thr    | Ser         |      |
|      | 290 |           | _           |      |     | 295          |             |     |     |         | 300  |       |      |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
| tat  | aac | tcc       | aat         | atσ  | gtt | tcc          | cac         | tac | tag | ttt     | gaa  | tcg   | cta  | gca    | ggt         | 960  |
|      |     |           |             |      | Val |              |             |     |     |         |      |       |      |        |             |      |
| 305  |     |           | <b></b> 1   |      | 310 |              |             |     | •   | 315     |      |       |      | -      | 320         |      |
| 303  |     |           |             |      | 010 |              |             |     |     |         |      |       |      |        |             |      |
|      |     | +~~       | <b>~~</b> ~ | at a | gaa | at c         | acc         | tet | raa | ttc     | cac  | tat   | cac  | aaa    | tct         | 1008 |
|      |     |           |             |      | Glu |              |             |     |     |         |      |       |      |        |             |      |
| me   | Pro | Cys       | Asp         |      | GIU | TIE          | Ala         | Ser | 330 | FIIG    | Ary  | - 7 - | Ary  | 335    | 001         |      |
|      |     |           |             | 325  |     |              |             |     | 330 |         |      |       |      | 333    |             |      |
|      |     |           |             |      |     |              |             |     |     | <b></b> |      |       |      |        | <b>~</b> ~~ | 1056 |
|      |     |           |             |      | agc |              |             |     |     |         |      |       |      |        |             | 1036 |
| Ala  | Val | Arg       | _           | Asn  | Ser | Leu          | Met         |     | Thr | Leu     | ser  | GIN   |      | GIA    | GIU         |      |
|      |     |           | 340         |      |     |              |             | 345 |     |         |      |       | 350  |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
|      |     |           |             |      | gct |              |             |     |     |         |      |       |      |        |             | 1104 |
| Thr  | Ala | Asp       | Thr         | Leu  | Ala | Gly          | Leu         | Arg | Leu | Ser     | Lys  | Glu   | Leu  | Gly    | Tyr         |      |
|      | -   | 355       |             |      |     |              | 360         |     |     |         |      | 365   |      |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
|      |     |           |             |      | atc |              |             |     |     |         |      |       |      |        |             | 1152 |
| Leu  | Gly | Ser       | Leu         | Ala  | Ile | Cys          | Asn         | Val | Pro | Gly     | Ser  | Ser   | Leu  | Val    | Arg         |      |
|      | 370 |           |             |      |     | 375          |             |     |     |         | 380  |       |      |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
| gaa  | tcc | gat       | ctg         | gcg  | cta | atg          | acc         | aac | gcg | ggt     | aca  | gaa   | atc  | ggc    | gtg         | 1200 |
| Glu  | Ser | Asp       | Leu         | Ala  | Leu | Met          | Thr         | Asn | Ala | Gly     | Thr  | Glu   | Ile  | Gly    | Val         |      |
| 385  |     | _         |             |      | 390 |              |             |     |     | 395     |      |       |      |        | 400         |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
| gca  | tcc | act       | aaa         | gca  | ttc | acc          | act         | cag | tta | act     | gtg  | ctg   | ttg  | atg    | ctg         | 1248 |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        | Leu         |      |
|      |     |           | -1-         | 405  |     |              |             |     | 410 |         |      |       |      | 415    |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        |             |      |
| ~+ ~ | ~~~ |           | cta         | tat  | cac | cta          | 222         | aat | cta | gat     | acc  | tcc   | att  | σаа    | cat         | 1296 |
|      |     |           |             |      | Arg |              |             |     |     |         |      |       |      |        |             |      |
| Val  | міа | пуз       |             |      | Arg | пси          | <b>Ly 5</b> | 425 |     |         |      |       | 430  |        |             |      |
|      |     |           | 420         |      |     |              |             | 743 |     |         |      |       |      |        |             |      |
|      |     | <b></b> . | <b></b> -   | ~~-  | a+~ | <b>~</b> ~ ~ | ~~~         | ~+~ | ~~~ | 200     | cat  | a++   | as a | רפת    | atg         | 1344 |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        | Met         | 2011 |
| Asp  | тте |           |             | GTA  | neu | GIH          |             |     | 110 | PET     | AT 9 | 445   |      | . 0111 |             |      |
|      |     | 435       |             |      |     |              | 440         |     |     |         |      | 113   |      |        |             |      |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        | ~           | 1202 |
|      |     |           |             |      |     |              |             |     |     |         |      |       |      |        | gac         | 1392 |
| Leu  | Ser | Gln       | Asp         | Lys  | Arg |              |             | Ala | Leu | Ala     |      |       | Phe  | Ser    | Asp         |      |
|      | 450 |           |             |      |     | 455          |             |     |     |         | 460  |       |      |        |             |      |

| aaa cat<br>Lys His<br>465                |                |                          |                   |            |                   |                   |                   |                   |            |                   |                   |                   |                   | 1440 |
|--|----------------|--------------------------|-------------------|------------|-------------------|-------------------|-------------------|-------------------|------------|-------------------|-------------------|-------------------|-------------------|------|
| ctg gaa<br>Leu Glu                       | ggc go         | ca ttg<br>la Leu<br>485  | aag<br>Lys        | ttg<br>Leu | aaa<br>Lys        | gag<br>Glu        | atc<br>Ile<br>490 | tct<br>Ser        | tac<br>Tyr | att<br>Ile        | cac<br>His        | gct<br>Ala<br>495 | gaa<br>Glu        | 1488 |
| gcc tac<br>Ala Tyr                       | Ala A          |                          |                   |            |                   |                   |                   |                   |            |                   |                   |                   |                   | 1536 |
| gcc gat<br>Ala Asp                       | atg co         | cg gtt<br>ro Val         | att<br>Ile        | gtt<br>Val | gtt<br>Val<br>520 | gca<br>Ala        | ccg<br>Pro        | aac<br>Asn        | aac<br>Asn | gaa<br>Glu<br>525 | ttg<br>Leu        | ctg<br>Leu        | gaa<br>Glu        | 1584 |
| aaa ctg<br>Lys Leu<br>530                |                |                          |                   |            |                   |                   |                   |                   |            |                   |                   |                   |                   | 1632 |
| tat gtc<br>Tyr Val<br>545                | ttc g<br>Phe A | cc gat<br>la Asp         | cag<br>Gln<br>550 | gat<br>Asp | gcg<br>Ala        | ggt<br>Gly        | ttt<br>Phe        | gta<br>Val<br>555 | agt<br>Ser | agc<br>Ser        | gat<br>Asp        | aac<br>Asn        | atg<br>Met<br>560 | 1680 |
| cac atc<br>His Ile                       |                |                          | Pro               |            |                   |                   |                   |                   |            |                   |                   |                   |                   | 1728 |
| tac acc<br>Tyr Thr                       | Val P          | cg ctg<br>Pro Leu<br>880 | cag<br>Gln        | ctg<br>Leu | ctg<br>Leu        | gct<br>Ala<br>585 | tac<br>Tyr        | cat<br>His        | gtc<br>Val | gcg<br>Ala        | ctg<br>Leu<br>590 | atc<br>Ile        | aaa<br>Lys        | 1776 |
| ggc acc<br>Gly Thr                       |                |                          |                   |            |                   | Asn               |                   |                   |            |                   | Val               |                   |                   | 1824 |
| gag taa<br>Glu<br>610                    |                |                          |                   |            |                   |                   |                   |                   |            |                   |                   |                   |                   | 1830 |
| <210> 3<br><211> 6<br><212> P<br><213> E | 09<br>RT       | ichia (                  | coli              |            |                   |                   |                   |                   |            |                   |                   |                   |                   |      |
| <400> 3<br>Met Cys                       |                | Ile Val                  | L Gly             | ' Ala      | Ile               | : Ala             | Gln               | Arg               | Asp        | Val               | Ala               | Glu               | lle               |      |

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|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| Leu        | Leu        | Glu        | Gly<br>20  | Leu        | Arg        | Arg        | Leu        | Glu<br>25  | Tyr        | Arg        | Gly        | Tyr        | Asp<br>30  | Ser        | Ala        |
| Gly        | Leu        | Ala<br>35  | Val        | Val        | Asp        | Ala        | Glu<br>40  | Gly        | His        | Met        | Thr        | Arg<br>45  | Leu        | Arg        | Arg        |
| Leu        | Gly<br>50  | Lys        | Val        | Gln        | Met        | Leu<br>55  | Ala        | Gln        | Ala        | Ala        | Glu<br>60  | Glu        | His        | Pro        | Leu        |
| His<br>65  | Gly        | Gly        | Thr        | Gly        | Ile<br>70  | Ala        | His        | Thr        | Arg        | Trp<br>75  | Ala        | Thr        | His        | Gly        | Glu<br>80  |
| Pro        | Ser        | Glu        | Val        | Asn<br>85  | Ala        | His        | Pro        | His        | Val<br>90  | Ser        | Glu        | His        | Ile        | Val<br>95  | Val        |
| Val        | His        | Asn        | Gly<br>100 | Ile        | Ile        | Glu        | Asn        | His<br>105 | Glu        | Pro        | Leu        | Arg        | Glu<br>110 | Glu        | Leu        |
| Lys        | Ala        | Arg<br>115 | Gly        | Tyr        | Thr        | Phe        | Val<br>120 | Ser        | Glu        | Thr        | Asp        | Thr<br>125 | Glu        | Val        | Ile        |
| Ala        | His<br>130 | Leu        | Val        | Asn        | Trp        | Glu<br>135 | Leu        | Lys        | Gln        | Gly        | Gly<br>140 | Thr        | Leu        | Arg        | Glu        |
| Ala<br>145 |            | Leu        | Arg        | Ala        | Ile<br>150 |            | Gln        | Leu        | Arg        | Gly<br>155 | Ala        | Tyr        | Gly        | Thr        | Val<br>160 |
| Ile        | Met        | Asp        | Ser        | Arg<br>165 |            | Pro        | Asp        | Thr        | Leu<br>170 |            | Ala        | Ala        | Arg        | Ser<br>175 | Gly        |
|            |            |            | 180        |            |            |            |            | 185        |            |            |            |            | 190        |            | Ser        |
| _          |            | 195        |            |            |            |            | 200        |            |            |            |            | 205        | 1          |            | Glu        |
|            | 210        |            |            |            |            | 215        | 1          |            |            |            | 220        |            |            |            | Asp        |
| 225        |            | _          |            |            | 230        | )          |            |            |            | 235        | •          |            |            |            | Gln<br>240 |
| Tyr        | Asp        | Ala        | Gly        | Asp        | Lys        | : Gly      | 7 Ile      | туг        | Arg        | , His      | Tyr        | Met        | Gln        | Lys        | Glu        |

Ile Tyr Glu Gln Pro Asn Ala Ile Lys Asn Thr Leu Thr Gly Arg Ile

| Ser | His | Gly | Gln | Val | Asp | Leu | Ser | Glu | Leu | Gly | Pro | Asn | Ala | Asp | Glu |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     | 275 |     |     |     |     | 280 |     |     |     |     | 285 |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |

Leu Leu Ser Lys Val Glu His Ile Gln Ile Leu Ala Cys Gly Thr Ser 290 295 300

Tyr Asn Ser Gly Met Val Ser Arg Tyr Trp Phe Glu Ser Leu Ala Gly 305 310 315 320

Ile Pro Cys Asp Val Glu Ile Ala Ser Glu Phe Arg Tyr Arg Lys Ser 325 330 335

Ala Val Arg Arg Asn Ser Leu Met Ile Thr Leu Ser Gln Ser Gly Glu 340 345 350

Thr Ala Asp Thr Leu Ala Gly Leu Arg Leu Ser Lys Glu Leu Gly Tyr 355 360 365

Leu Gly Ser Leu Ala Ile Cys Asn Val Pro Gly Ser Ser Leu Val Arg 370 375 380

Glu Ser Asp Leu Ala Leu Met Thr Asn Ala Gly Thr Glu Ile Gly Val 385 390 395 400

Ala Ser Thr Lys Ala Phe Thr Thr Gln Leu Thr Val Leu Leu Met Leu 405 410 415

Val Ala Lys Leu Ser Arg Leu Lys Gly Leu Asp Ala Ser Ile Glu His
420 425 430

Asp Ile Val His Gly Leu Gln Ala Leu Pro Ser Arg Ile Glu Gln Met
435 440 445

Leu Ser Gln Asp Lys Arg Ile Glu Ala Leu Ala Glu Asp Phe Ser Asp 450 455 460

Lys His His Ala Leu Phe Leu Ser Arg Gly Asp Gln Tyr Pro Ile Ala 465 470 475 480

Leu Glu Gly Ala Leu Lys Leu Lys Glu Ile Ser Tyr Ile His Ala Glu 485 490 495

Ala Tyr Ala Ala Gly Glu Leu Lys His Gly Pro Leu Ala Leu Ile Asp
500 505 510

Ala Asp Met Pro Val Ile Val Val Ala Pro Asn Asn Glu Leu Leu Glu

Lys Leu Lys Ser Asn Ile Glu Glu Val Arg Ala Arg Gly Gln Leu 530 540

Tyr Val Phe Ala Asp Gln Asp Ala Gly Phe Val Ser Ser Asp Asn Met 545 550 555 555

His Ile Ile Glu Met Pro His Val Glu Glu Val Ile Ala Pro Ile Phe 565 570 575

Tyr Thr Val Pro Leu Gln Leu Leu Ala Tyr His Val Ala Leu Ile Lys 580 585 590

Gly Thr Asp Val Asp Gln Pro Arg Asn Leu Ala Lys Ser Val Thr Val 595 600 605

Glu